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CIRCUIT DESCRIPTION

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ISSUE 2D
APPENDIX 3D
DWG ISSUE 7D

PBX SYSTEMS
NO. 756A
STATION MESSAGE REGISTER
PULSE AND SURCHARGE CIRCUIT

CHANGES

D. Description of Changes

D.1 The rating of this circuit is changed from AT&TCo
Standard to A&M Only.

BELL TELEPHONE LABORATORIES, INCORPORATED
DEPT 3224-WVS-RVL

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Page 1
1 Page

PBX SYSTEMS
NO. 756A
STATION MESSAGE REGISTER
PULSE AND SURCHARGE CIRCUITCHANGESB. Changes in Apparatus

<u>B.1</u>	<u>Removed</u>	<u>Replaced By</u>
	ALM Diode 446F - Fig. 4	ALM Diode 458A - Fig. 4

D. Description of Changes

D.1 This circuit is reissued to correct the release monitor alarm portion of this circuit as follows:

(a) Pin designations 3 and 4 of the J1 connector are reversed to correct the connecting information to the relay timer delay circuit (ALM).

(b) Series diode ALM is removed and placed in parallel with relay ALM to provide more reliable transistor protection for the relay timer delay circuit (ALM). Also, the code of diode ALM is changed from 446F to 458A.

D.2 On sheet A1, the sheet index is brought up to date.

D.3 On sheet A2, the coordinate location for diode ALM is revised.

D.4 On sheet C1, the code of diode ALM is changed from 446F to 458A. Also, coordinate locations for pins 3 and 4 of the J1 connector and diode ALM are revised.

D.5 On sheet G2, TS(C), pin 18: The pin designation of the J1 connector is changed from pin 3 to pin 4.

BELL TELEPHONE LABORATORIES, INCORPORATED

(WECO 5120HW-JJM-LKJ)
DEPT. 5337-RVL

PBX SYSTEMS
NO. 756A
STATION MESSAGE REGISTER
PULSE AND SURCHARGE CIRCUIT

CHANGES

D. Description of Changes

- D.1 This circuit is reissued to provide for message registration and surcharge registration on a per trunk basis.
- D.2 Option K is added and rated Standard to provide message registration on a per trunk basis.
- D.3 Options V and W are rated Manufacture Discontinued and option J is added and rated Standard to provide surcharge registration on a per trunk basis.
- D.4 On sheet A1, the sheet index is brought up to date.
- D.5 On sheet A2, options J and K are added to the option index.
- D.6 On sheet D1: Circuit Note 102 is revised for clarification, Circuit Note 104 is revised to reflect the changes in this issue, and Equipment Notes 204 and 205 are added.
- D.7 On sheets G1, G2 and G4, the CADs are revised to reflect the changes made on this issue.

F. Changes in CD Sections

F.1 Under TABLE OF CONTENTS, SECTION II - DETAILED DESCRIPTION, add:

- 5. OPTIONS.....
 - A. Options Applying to or Affecting the Station Message Register Pulse and Surcharge Circuit.....

F.2 In TABLE A - MESSAGE UNIT PULSE PATTERNS: Delete options V and W from the Circuit Options column and replace option V with option J.

F.3 In SECTION II - DETAILED DESCRIPTION, change the minor heading on Page 2 to read as follows:

Without Surcharge Circuit (Options X and J)

F.4 In SECTION II, under major heading C, change the minor heading to read as follows:

Without Surcharge Circuit (Options Z and J)

F.5 In SECTION II, under major heading D, change the minor heading to read as follows:

Without Surcharge Circuit (Options Y, X, and J)

F.6 In SECTION II, add Part 4 omitted erroneously on rewrite for Issue 2D of this CD as follows:

4. MISCELLANEOUS FEATURES

4.01 The surcharge circuit may be tested by the following procedure.

- (a) Observe that the circuit is idle by verifying the unoperated condition of relay MS and absence of ground on lead S1.
- (b) Manually operate relay MS. This starts the surcharge circuit.
- (c) Observe that associated pulse circuit relay SX operates and releases.
- (d) Count the number of operations of pulse relay SX. This should correspond to the surcharge units specified for the particular installation.
- (e) Alternative check: Connect the (+) terminal of a test voltmeter to ground at unit terminal strip and the (-) terminal to lead AA. Count the number of downscale swings during a simulated surcharge sequence. This should correspond to the number of surcharge units specified for the particular installation.

4.02 This test procedure does not change the registration on any station line register or trunk register.

F.7 In SECTION II, add Part 5 as follows:

5. OPTIONS

A. Options Applying to or Affecting the Station Message Register Pulse and Surcharge Circuit

5.01 Optional wiring and apparatus arrangements to provide certain operating features of the circuit are shown in Table B.

TABLE B
OPTIONS APPLYING TO OPERATING CONDITIONS

OPTION	DESCRIPTION
V(MD)	Provides wiring when surcharge registration is not required on all C.O. Trunks
K	Provides wiring for those C.O. Trunks on which message registration is not required
J	Provides wiring for those C.O. Trunks on which surcharge registration is not required.
W(MD)	Provides wiring when pulse pattern B (Table A) is required for message registration and surcharge registration is not required.

BELL TELEPHONE LABORATORIES, INCORPORATED

(WECO 5120HW-JJM-LKJ)
DEPT 5337-RVL

PBX SYSTEMS
NO. 756A
STATION MESSAGE REGISTER
PULSE AND SURCHARGE
CIRCUIT

TABLE OF CONTENTS	Page	TABLE OF CONTENTS	Page
<u>SECTION I - GENERAL DESCRIPTION</u> . . .	1	B. Registration Pulse Applied - Marker in Camp - On Call Termin- ation (SC5)	4
1. <u>PURPOSE OF CIRCUIT.</u>	1	4. <u>MISCELLANEOUS FEATURES.</u>	
2. <u>GENERAL DESCRIPTION OF OPERATION.</u>	1	<u>SECTION III - REFERENCE DATA.</u>	5
<u>SECTION II - DETAILED DESCRIPTION</u> . . .	2	1. <u>WORKING LIMITS.</u>	5
1. <u>TRANSFER OF CENTRAL OFFICE</u> <u>REGISTRATION.</u>	2	2. <u>FUNCTIONAL DESIGNATIONS</u>	5
A. General	2	3. <u>FUNCTIONS</u>	5
B. Registration of Message Unit Charge (SC1)	2	4. <u>CONNECTING CIRCUITS</u>	6
C. Long Pulse Cutoff (SC2)	3	5. <u>ALARM INFORMATION</u>	6
D. Post Call Pulse Hold (SC3)	3	6. <u>MANUFACTURING TESTING</u> <u>REQUIREMENTS.</u>	6
2. <u>SURCHARGE REGISTRATION (SC4).</u> . . .	4	7. <u>TAKING EQUIPMENT OUT OF SERVICE</u>	6
A. End of Call	4	<u>SECTION IV - REASONS FOR REISSUE.</u> . .	6
B. Registration of Zero to Six Surcharges.	4	D. Description of Changes.	6
3. <u>FUNCTION OF MARKER CONTROLLER</u> <u>CIRCUIT (FSB)</u>	4		
A. General	4		

TABLE A
MESSAGE UNIT PULSE
PATTERNS

TYPE	START OF PULSE (S)	END OF PULSE (S)	CIRCUIT OPTIONS
A. Single or multiple pulse	Shortly (2-5 sec.) after calling and called party are connected	Last pulse ends before either calling or called party are disconnected	X or X and V
B. Single post call pulse	Within 450 milli-seconds after disconnect of calling or called party	About 200 milli-seconds after start of pulse	Y and X or Y, X, V and W
C. Single long pulse	Shortly (2-5 sec.) after calling and called party are connected	When trunk circuit is released	Z or Z and V

SECTION I - GENERAL DESCRIPTION

1. PURPOSE OF CIRCUIT

1.01 The station message register pulse and surcharge circuit provides for transferring message unit registrations originating in a central office to message registers associated with the trunk and PBX station.

1.02 By using a surcharge applique (FS2) with the station message register pulse circuit (FS1) a preset number of surcharge units are added to the station line registration for each completed call.

2. GENERAL DESCRIPTION OF OPERATION

2.01 Message unit pulses originating in the central office equipment are transmitted to the message register pulse circuit over a third wire associated with each PBX trunk

2.02 The driving circuit at the central office applies -48V pulses to the third wire. These pulses must be applied in one of the patterns shown in Table A. The type of pulse pattern applied depends on the type of central office equipment involved.

2.03 The surcharge circuit may be arranged for adding from 0 to 6 message units at the end of each call just before the line circuit of the calling station is released from the trunk. Pulses required for surcharge registration are originated by the surcharge circuit (FS2).

SECTION II - DETAILED DESCRIPTION

1. TRANSFER OF CENTRAL OFFICE REGISTRATIONS

A. General

1.01 When a call has been established via a PBX trunk and central office circuits, the central office applies one or more battery pulses to a third wire associated with the PBX trunk and its station message register pulse and surcharge circuit.

1.02 Pulses from the central office for message unit registration must be in one of the patterns shown in Table A.

1.03 The station message register pulse circuit must be equipped with the indicated option or options for proper registration of the message unit pulses.

B. Registration of Message Unit Change (SC1)

Without Surcharge Circuit (Options X and V)

1.04 The pulse train for pulse pattern A (Table A) contains a number of pulses corresponding to the basic message unit charge for the call.

1.05 A battery on the third wire from the central office is applied via lead M to operate relay SX over its primary winding.

1.06 Relay SX operated:

(a) Applies +48V via lamp MR and lead SS1 through the crosspoints of the operated switches to score the line message register (LINE) associated with the calling PBX station.

(b) Applies battery via resistor TR to score the trunk message register (TRK) associated with the trunk circuit.

(c) Operates relay COD.

1.07 Diode SX between leads SS1 and SS2 provides a path to the line hold magnet (LHM) in the line, link, and marker circuit and prevents +48V from reaching leads M and SS2. During the operation of relay SX, LHM is held operated by relay SR in the central office trunk circuit via lead SS1, diode SX, and lead SS2. Once relay SX has fully operated, the +48 volts applied to lead SS1 to score the message register (LINE) holds LHM operated.

1.08 Removal of the battery pulse from lead M releases relay SX which in turn releases relay COD and message register LINE and TRK thus returning the message register pulse circuit to normal.

1.09 If the call requires registration of several message units the action of operating and releasing relay SX is repeated for each message unit. This scores the corresponding number of counts on the station line message register and the trunk register. Relay COD follows each operation of relay SX.

With Surcharge Circuit (Option X)

1.10 When the surcharge circuit is provided, the operation of the pulse circuit is identical to that described previously with the exception that the operation of relay SX also operates relay MS in the surcharge circuit.

1.11 Relay MS operated:

(a) Locks operated.

(b) Prepares a path for its own shunt down release.

(c) Provides a holding path for relay SR in the trunk circuit via lead SR and diode PP.

(d) Connects terminals of SC selector arc 1 to the secondary winding of pulse circuit relay SX to prepare for registration of surcharge at the end of the call.

(e) Prepares a path for operating magnet ROT of selector SC when relay IMP operates.

(f) Prepares a path for operating relay DS when relay S1 in the trunk circuit releases at the end of the call.

1.12 When the calling station disconnects, relay S1 in the trunk circuit releases. Release of relay S1 removes the shunt down path provided by lead S1, and relay DS in the surcharge circuit operates via lead SS2. The circuitry is now set for surcharge registration and proceeds to function as described in Section 2.

C. Long Pulse Cut-Off (SC2)

Without Surcharge Circuit (Options Z and V)

- 1.13 The pulse train for pulse pattern C (Table A) contains a single long pulse and only one registration will be made.
- 1.14 A battery pulse on lead M operates relay SX which in turn performs the functions described in Registration of Message Unit Charge and in addition applies battery via resistor TR and diode LP to relay P. The operation of relay P is delayed due to the action of thermister LP in its ground path. If relay SX remains operated longer than 200 to 1000 (nominal 500) milli-seconds, relay P operates.
- 1.15 Relay P operated:
- (a) Locks to the pulse on lead M.
 - (b) Short circuits thermister LP.
 - (c) Releases relay SX.
- 1.16 Relay SX released:
- (a) Releases the station line message register (LINE) and the trunk message register (TRK) in the message register circuit.
 - (b) Releases relay COD.
- 1.17 An important function of relay P is to shorten the interval during which +48V is connected to the sleeve lead of the PBX switch train. This reduces the interval which a maximum load may be imposed on the +48V supply by simultaneous charging in a number of trunk circuits, and reduce the interval during which the line, link, and marker circuit is prevented from making a camp-on type connection.
- 1.18 When the call is terminated by the calling party, the battery pulse is removed from lead M. Removal of the battery pulse begins the slow release of relay P. Once relay P is released, the pulse circuit is returned to normal.

With Surcharge Circuit (Option Z)

- 1.19 When the surcharge circuit is provided, the operation of the pulse circuit is identical to that described previously with the exception that the operation of relay SX also operates relay MS in the surcharge circuit. Relay MS operated performs the same functions as described in Registration of Message Unit Charge.
- 1.20 When the calling station disconnects, relay S1 in the trunk circuit releases operating relay DS in the surcharge circuit. The circuitry is now set for surcharge re-

gistration and proceeds to function as described in Section 2.

D. Post Call Pulse Hold (SC3).

Without Surcharge Circuit (Options Y, X, V and W).

- 1.21 The pulse train for pulse pattern B (Table A) contains a single pulse and only one registration will be made after the calling station has disconnected.
- 1.22 When the calling station is connected to the central office trunk circuit, trunk relay S1 operates. Relay S1 operated connects ground via lead S1 and thermister PP to relay P. The operation of relay P is delayed 1 to 5 (nominal 2.5) seconds by thermister PP to prevent premature operation of relay SR via lead SR.
- 1.23 Relay P operated:
- (a) Provides a holding ground for trunk circuit relay SR.
 - (b) Short circuits thermister PP.
- 1.24 When the call is terminated by the calling party, trunk circuit relay S1 releases and starts the slow release of relay P. The combined release times of relays S1 and P provide a minimum of 450 milli-seconds before starting the slow release of trunk circuit relay SR. During this interval, a battery pulse is applied from the central office to lead M. The battery pulse operates relay SX which in turn performs the functions described in Registration of Message Unit Charge.
- 1.25 When relay P has released, the pulse on the M lead from the central office is removed and relay SX releases. Relay SX released returns the pulse circuit to normal.

With Surcharge Circuit (Options Y and X)

- 1.26 When the surcharge circuit is provided, the operation of the pulse circuit is identical to that described previously with the exception that the operation of relay SX also operates relay MS in the surcharge circuit. Relay MS operated performs the same functions as described in Registration of Message Unit Charge.
- 1.27 The release of relay P removes the shunt down path provided and relay DS in the surcharge circuit operates via lead SS2. The circuitry is now set for surcharge registration and proceeds to function as described in Section 2.

2. SURCHARGE REGISTRATION (SC4)

A. End of Call

2.01 When the call is terminated by the calling party, relay S1 in the trunk circuit releases, thus removing shunt-down ground from relay DS. Relay DS operates by the previously operated relay MS and trunk circuit relay SR. With option Y, operation of relay DS is delayed by the slow release of pulse circuit relay P.

2.02 Relay DS operated:

- (a) Locks operated under control of trunk circuit relay SR.
- (b) Opens the shunt-down path to ground at relay S1 in the trunk circuit.
- (c) Connects ground via lead ST to relay IMP. Relay IMP operates from the interrupter circuit of the 756A PBX at a rate of 120 ipm.
- (d) Connects ground to the release monitor alarm circuit (FS7).
- (e) Connects ground supplied from relay IMP to arc 1 of selector SC and by previously operated relay MS, to magnet ROT of selector SC.
- (f) Opens the path via selector off-normal contacts for operating magnet RLS of selector SC.
- (g) Removes ground from lead H to the central office trunk circuit to prevent the completion of an incoming call to the PBX station that is being held for surcharge registration.
- (h) Opens the path between leads R1 and R2 to the central office trunk to prevent ringing on an incoming call during surcharge registration.

B. Registration of Zero to Six Surcharges

- 2.03 The first operation of relay IMP at the end of a call (if of sufficient duration) energizes magnet ROT of selector SC. The selector is rotated to step 1.
- 2.04 To insure that full pulses are gotten from the interrupter started by relay IMP, step 1 is unused.
- 2.05 With the selector stepped off-normal the selector off-normal contacts are closed. This prepares a path for operating selector RLS when relay DS releases.
- 2.06 To allow time for any post-call lead M charge to disappear, selector step 2 is unused and 3 is used for zero surcharge.

2.07 When the selector is stepped to position 4, 120-ipm ground is applied by arc 1 and operated relay MS to operate pulse circuit relay SX on its secondary winding.

2.08 This partially registers a count on the station line message register and operates relay COD. During the 120-ipm off period, the count registration is completed.

2.09 Subsequently ground impulses on lead IMP step the selector to subsequent positions scoring the station message register each time.

2.10 After registering the last surcharge for which the unit is wired, the release of pulse circuit relay SX applies ground by wiper and arc 2 of the selector SC to the winding of relay MS causing its release by shunt-down action.

2.11 Relay MS, in releasing, opens the impulse path to magnet ROT and releases the trunk circuit relay SR which in turn releases relay DS.

2.12 Relay DS released completes a path by closed selector off-normal contacts for operating magnet RLS of the selector. Ground is restored on lead H to the two-way trunk circuit. Leads R1 and R2 are reclosed to the trunk circuit completing the operating path of trunk relay RL.

2.13 With its release magnet energized, the selector restores to normal. Other off-normal make contacts open to de-energize the release magnet.

2.14 The trunk and message register pulse and surcharge circuit are restored to normal and are ready for the next usage.

3. Function of Marker Controller Circuit (FS8)

A. General

3.01 Operation of relay SX in the pulsing circuit operates relay COD in the marker controller circuit. If relay COD is operated prior to the operation of marker relays HMKA,B during a camp-on call termination, the link testing function of the marker circuit will be disabled and the camp-on call termination will not be made. The manner in which the marker controller circuit performs this function depends on marker options XK and WV.

B. Registration Pulse Applied - Marker in Camp-On Call Termination (SC5)

Marker Circuit Equipped with Option XK (Option T provided).

3.02 Relay COD operated:

- (a) Locks under control of marker relays COTA, B.
 - (b) Transfers the operating path of marker relays CONA, AA, B, BA to relay H.
- 3.03 Operation of marker relays HMKA, B operates relay H. Relay H operated:
- (a) Operates C.O. trunk relay RS.
 - (b) Provides a holding ground for marker relay DCKA, B.
 - (c) Provides a holding ground for the trunk hold magnet THM-- and trunk relay HM.
 - (d) Prepares a path to operate relay BY in the register.
 - (e) Operates relay ST in the busy verification circuit if the marker is performing the camp-on operation in connection with busy verification.
- 3.04 During the marker release: relay H releases, and relay COD will release provided relay SX in the pulse circuit has released.

Marker Circuit Equipped With Option WV (Option S provided).

- 3.05 Relay COD operated:
- (a) Locks under control of marker relays COTA, B.
 - (b) Transfers the operating path of marker relays CONAA, BA to relay H.
 - (c) Prevents the operation of marker alarm relays COAL and XCAL.
- 3.06 Operation of marker relays HMKA, B operates relay H. Relay H operated:
- (a) Operates relay ST in the busy verification circuit if the marker is performing the camp-on operation in connection with busy verification.
 - (b) Prevents the operation of marker alarm relay LALI when marker relays CONA, B operate and CONAA, BA do not.
 - (c) Removes ground from leads MR5 and MR6 to prevent marker relays LTCA, B from operating.
- 3.07 During the marker release: relay H releases, and relay COD will release provided relay SX in the pulse circuit has released.

SECTION III - REFERENCE DATA

1. WORKING LIMITS

1.01 Maximum resistance of third wire plus ground return resistance.

Max. Adverse Ground Pot	Max. Res. of Third Wire Plus Ground Return Resistance	
	Co Batt. 40V Min.	Co Batt. 45V Min.
0	1040	1345
1	980	1285
2	920	1225
3	865	1165
4	865	1105
5	750	1040
10	465	750

Note: Linear extrapolation may be used to obtain maximum permissible resistance for other values of CO battery and adverse ground potential.

1.02 Minimum insulation resistance (third wire to ground) 50,000 ohms.

2. FUNCTIONAL DESIGNATIONS

2.01 Relays

<u>Designation</u>	<u>Meaning</u>
ALM	Alarm
COD	Camp-On Denied
DS	Disconnect Started
H	Hold
IMP	Impulse (120 or 60-ipm)
MR	+48V Fuse Alarm
MS	Message (Charge) Started
NV	No Voltage
P	Pulse (For Option Y or Z)
SX	Sleeve Switching.

2.02 Selectors

<u>Designation</u>	<u>Meaning</u>
SC	Surcharge Control

3. FUNCTIONS

- 3.01 To operate a line message register individual to a PBX station in accordance with message unit registration pulses originated at the connected central office.
- 3.02 To operate a trunk message register individual to a central office trunk in accordance with message unit registration originated at the connected central office.
- 3.03 To activate a message registration alarm lamp and the PEX common alarm circuit when surcharge registration is not completed during a specific interval after termination of a trunk call.
- 3.04 To disable the link testing function of the line, link and marker circuit during a camp-on call termination when in the process of scoring a message register.

4. CONNECTING CIRCUITS

4.01 When this circuit is listed on a key sheet, the connecting information thereon should be followed.

4.02 The station message register pulse and surcharge circuit as used in the 756A PBX system has the following typical connecting and associated circuits:

- (a) Two-Way Trunk Circuit to Central Office - SD-65752-01.
- (b) Message Register Circuit - SD-65852-01.
- (c) Line, Link, and Marker Circuit - SD-65741-01.
- (d) Alarm, Transfer and Test Circuit - SD-66796-01.
- (e) Relay Time Delay Circuit - SD-99361-01.
- (f) Interrupter Circuit - SD-81288-01.
- (g) Busy Verification Auxiliary Trunk Circuit - SD-66911-01.

4.03 The central office circuit to which the PBX trunk has access must be arranged to apply message registration pulses to a third wire (lead M) associated with each PBX trunk pair.

5. ALARM INFORMATION

5.01 The rectifier +48V power supply holds relay NV operated over unfused lead NV. Failure of the +48V supply releases the PBX power failure alarm and lights lamp NV.

5.02 The failure of a +48V fuse operates relay MR grounding lead EXT to actuate the PBX alarm circuit and lights lamp MR.

5.03 When relay DS operates during surcharge, ground is connected to the relay time delay circuit. If surcharges are not registered within approximately 2 minutes after the station disconnects,

relay ALM will operate. Relay ALM operated lights lamp RA and applies ground via lead EXT to the alarm, transfer, and test circuit resulting in a failure alarm.

6. MANUFACTURING TESTING REQUIREMENTS

6.01 The station message register pulse and surcharge circuit shall be capable of performing all of the functions given in this circuit description; the relays with which it is equipped shall meet all requirements of the circuit requirements table.

7. TAKING EQUIPMENT OUT OF SERVICE

7.01 During maintenance of the station message register pulse and surcharge circuit, the associated two-way CO trunk should be made busy at the central office to prevent incoming calls.

7.02 The station message register pulse and surcharge circuit may be disabled by blocking relay SX unoperated. In this condition the associated CO trunk circuit may be used for incoming and outgoing calls, but message unit charges will not be recorded on any station message register nor on the trunk register.

SECTION IV - REASONS FOR REISSUE

D. Description of Changes

D.1 Option T is designated and rated Additions and Maintenance Only. Option S is added and rated Standard to provide wiring to make the station message register pulse and surcharge circuit functional with the line, link, and marker circuit when the marker is equipped with option WV.

D.2 Option R is designated and rated Manufacture Discontinued to prevent interaction between two central office trunks over the sleeve lead when the marker circuit is setting up a camp-on connection. The break contact of relay SX is removed from between leads SS1 and SS2, since diode SX maintains the necessary continuity on these leads and also prevents any interaction between two central office trunk circuits. Option Q is added and rated Standard to revise wiring on sheet G1 (CAD 1) to accommodate the changes made necessary by the deletion of R wiring.

D.3 Option M is designated and rated Manufacture Discontinued. Option N is added and rated Standard to revise wiring on sheets G2 and G3 (CAD 3). Option N provides terminals for strapping either option S or option T.

D.4 On sheet D1, Circuit Note 104 is revised to reflect the changes in this issue and Circuit Note 106 is added.

D.5 On sheet E1, the sequence charts are revised and sheet note 1 is added.

D.6 On sheet E2, sequence chart SC4 is revised and Circuit Notes 1 and 2 on sequence chart SC5 are added.

D.7 On sheets G1, G2, and G3, CADS 1 and 3 are revised to reflect the changes in this issue.

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